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Department of Agriculture

Forest Service

**Northeastern Forest
Experiment Station**

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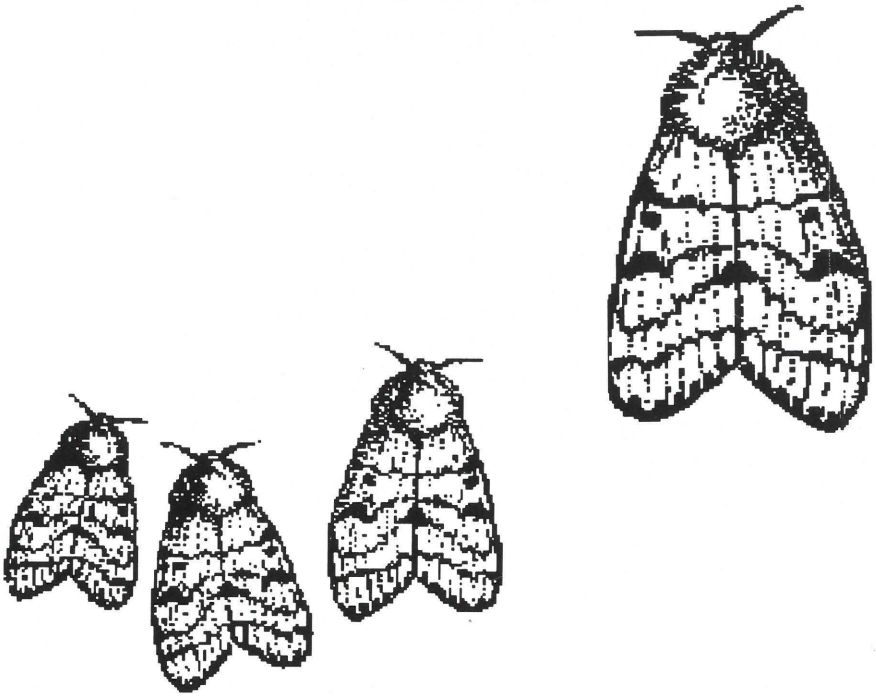
Defoliation Potential of Gypsy Moth



The gypsy moth (*Lymantria dispar* L.) may be the most notorious tree pest of our time. Accidentally released in 1869 by a French scientist living in Massachusetts, the gypsy moth has generally spread south and west leaving its mark in the form of millions of defoliated acres of forested land and dead trees. Since 1980, the gypsy moth has defoliated close to a million or more forested acres each year. In 1981 alone, a record 12.9 million acres were defoliated–an area larger than Rhode Island, Massachusetts, and Connecticut combined.

"Because it is a public menace", the gypsy moth has been extensively probed and analyzed by researchers. The result is a large body of knowledge about its destructive eating binges and their consequences. This knowledge has been useful to those charged with developing acceptable management strategies for controlling the gypsy moth. A group of resource analysts with the Forest Inventory and Analysis unit of the USDA Forest Service, Northeastern Forest Experiment Station, are applying knowledge of the forest resource to aid managers in coping with the pest.

Levels of defoliation vary greatly within areas infested by the gypsy moth. So, practical methods for identifying highly susceptible locations (that is, those most likely to suffer heavy defoliation during an infestation) would greatly aid forest resource and pest managers.

A model that links defoliation severity to key forest stand characteristics as predictor variables was developed in central Pennsylvania. It can be used to rate the defoliation potential of forest stands. For example, stands with the highest potential have at least 80 percent basal area in oak species, at least 70 percent basal area in chestnut and black oaks, and at least 60 percent basal area in trees with good crowns. Stands with the lowest rating have less than 20 percent basal area in oaks.

We applied the defoliation potential model to recent forest inventory plot data to calculate susceptibility ratings for counties in a seven state area where gypsy moth is an immediate threat. By design, each inventory plot represents a given proportional share of the forest area in a county. So, appropriate weights could be applied to susceptibility ratings for individual plots to derive average ratings for each county. Exceptions are counties designated non-forest (such as Philadelphia County in Pennsylvania) where no ground plots have been sampled.

Only three of the four variables included in the defoliation potential model could be used in the analysis. Crown condition was not measured by forest inventory crews and no appropriate surrogates for the crown condition variable are available. This is not a serious problem because crown condition does not account for a large amount of the variation in defoliation.

Susceptibility ratings for counties range from a high of 25.8 to a low of 9. Rating class boundaries of <12, 12-17.9, and 18+ were used to sort counties into three groups representing low, medium, and high levels of defoliation potential. Results were mapped to show current defoliation potential for counties in the seven state area.

Using county ratings to estimate the distribution of susceptible forest has its limitations. Counties with low susceptibility ratings can contain areas with high defoliation potential and vice versa. Average ratings for counties tell us nothing about the amount or location of susceptible forest within a county. For example, Pike and Lebanon Counties in Pennsylvania both have high ratings but Pike has five times more forest land. Also, ratings for counties with very little forest are based on data from very few ground plots and may be subject to high sampling errors.

Ratings for individual ground plots provide a more specific view of defoliation potential. The locations of individual plots have been digitized, so susceptibility ratings for each plot can be mapped. This map provides a better look at the spatial distribution of critical spots in the seven state region.

Results and Implications

The final products of this effort are susceptibility ratings and maps showing current defoliation potential in a seven state area where gypsy moth is an immediate concern. There are no major surprises here. Areas with the highest defoliation potential are those where oaks, especially chestnut and black are major components of the forest. Low ratings reflect the prevalence of species such as yellow-poplar, ash, red maple, black cherry, hemlock and pine that rank lower on the list of preferred hosts.

A comparison of ratings based on data from current forest inventories with those based on previous inventories reveals some shifts in defoliation potential. For example, Bedford County, Pennsylvania had a susceptibility rating of 20.2 in 1978. But heavy defoliation and drought during the 1980's led to high mortality, salvage cutting, and growth reduction in the oaks. At the same time, less preferred host species such as hemlock, yellow-poplar, white ash, black gum, birch, cherry and red maple flourished. By 1989, Bedford County's susceptibility rating dropped to 17.2. Future studies will take a closer look at changes in susceptibility for counties and individual plots.

Opportunities for extending the analysis to other states such as North Carolina, Tennessee, and Indiana should also be explored. The defoliation potential model should yield better results for areas with stand characteristics similar to those of the study area where it was developed. Who can say whether a post oak in the Ozarks of Missouri or sweet gum on the Coastal Plain of South Carolina will hold the same attraction for gypsy moth as a chestnut oak on a ridge in central Pennsylvania. For now, we hope the susceptibility ratings and maps of defoliation potential will give resource and pest managers in at least seven threatened states a better understanding of what to expect from the gypsy moth and thus a basis for improved decisions for coping with the pest.

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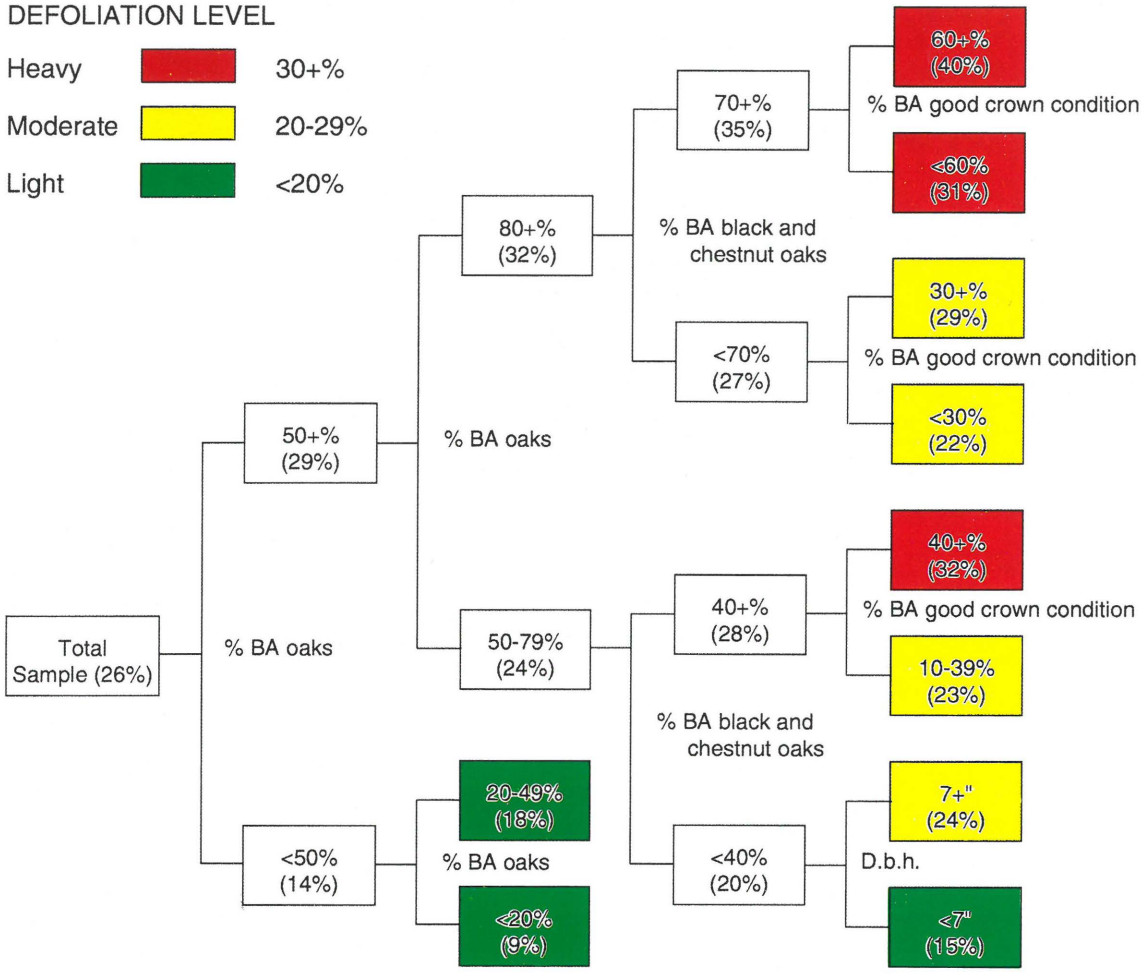
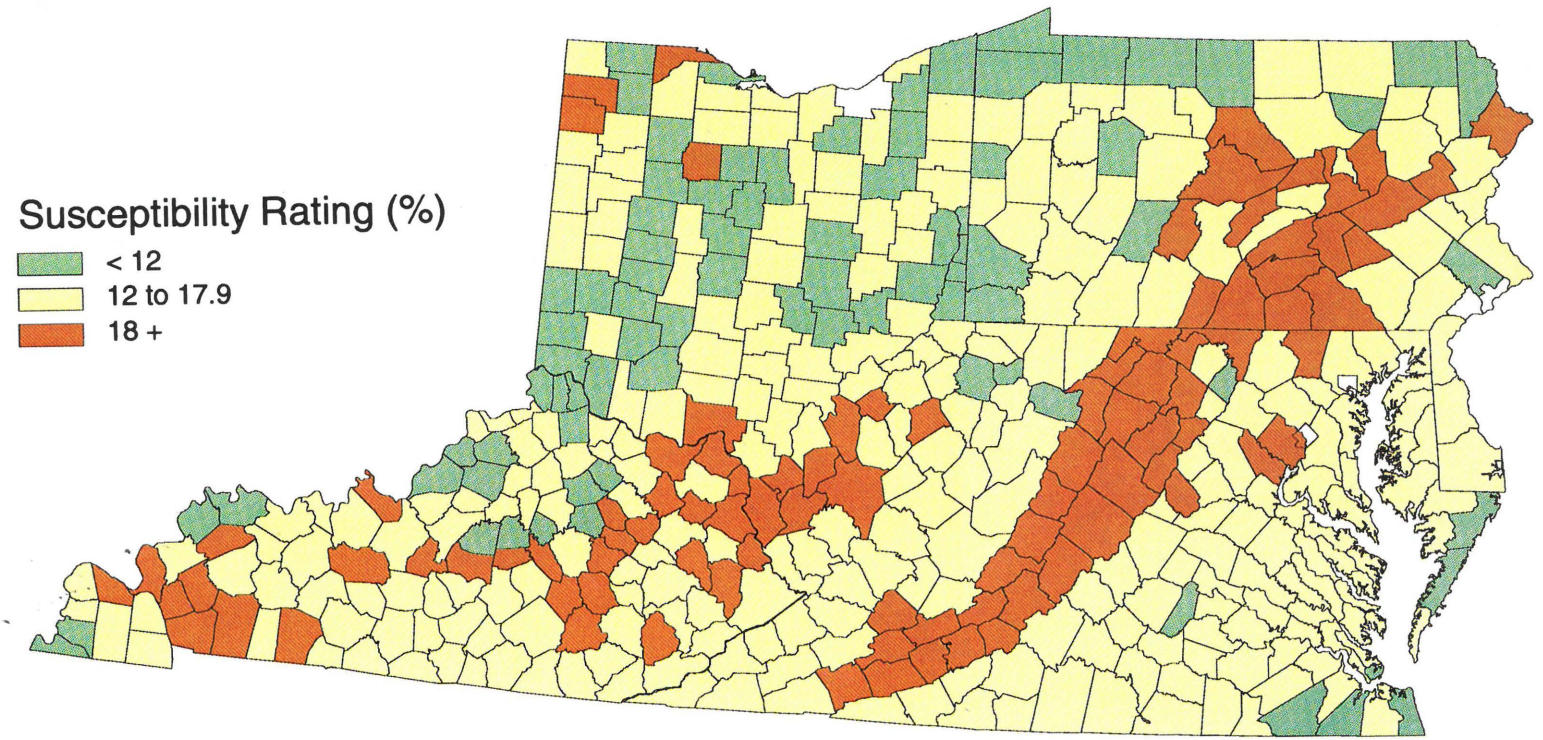
GUIDE FOR ESTIMATING DEFOLIATION POTENTIAL



Defoliation Potential -- Counties in 7 Threatened States



GYPSY MOTH DEFOLIATION POTENTIAL